



CORRELATION BETWEEN ASCENDING INFECTION AND SURGICAL DRAIN USE: A CROSS SECTIONAL STUDY

General Surgery

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ABSTRACT

Introduction: Drains are used as an integral tool in surgical practice, and have been used since the mid-1800s but, in recent years it is starting to be understood that the presence of a surgical drain and its prolonged use may be associated with an increased risk of infection. We aimed to identify whether drains could be considered an independent risk factor to ascending infections. **Methods:** The study aims to establish a correlation between ascending infection and the duration of drain usage. Thus, to minimise confounding variables that may lead to bacterial inoculation, this study only includes in situ drain tips from patients undergoing a clean surgery (with CDC class 1 wound) with a drain retained in situ for at least 72 hours. A positive culture is inferred as biofilm formation, which is taken to be a precursor to ascending infection. (n=43). **Findings:** This study demonstrates an increasing trend of biofilm formation within drains in situ with time. It ranges from 4.8-14.3% in patients who had drains in situ for 72 to 96 hours, to up to 28.6% after 96 hours. Even though an increasing trend is seen, the study could not prove that a statistically significant correlation exists between the infection due to the post-op usage of a drain and the time it is left in situ ($p=0.343$), even with possible skin contaminants being considered as positive results ($p=0.453$). **Conclusion:** There seems to be an increasing trend of infection with time but, since the scope of this study was limited by its small sample size, replication studies with a larger sample size and randomized controlled trials or meta-analyses on the topic are still required to ascertain correlation and causality. **Summary:** We aimed at finding a correlation between the duration of drain placement and ascending infection towards the surgical site. The results of this study indicate that with a longer usage time, there is a rise in rates of biofilm formation. The importance of this finding is that it points towards surgical drains as being one of the etiological factors of infection, but the same cannot be said conclusively and solely based on this study, and requires further investigation in the form of larger and more rigorous studies.

KEYWORDS

INTRODUCTION

The use of surgical drains after common surgeries like hernia repair, thyroidectomies, reduction and internal fixation etc. is commonplace. Even though it is known that prostheses like drains can help in reducing complications like haematomas and seromas, they may be factors in the establishment of a surgical site infection, if not handled in a proper fashion. There is a lack of consensus among studies conclusively citing the risks and benefits of drains to effectively assess whether they are directly implicated in the causation of surgical site infections. This study aims to find out whether drains increase the risk of infection, in conditions as close to ideally aseptic as possible, thus using only clean surgeries.

Some surgeons recommend postoperative antibiotic prophylaxis until drains are removed, but this practice may select for resistant organisms without impacting the infection rate.^{1,2,3} Prolonged antibiotic use also has other consequences including allergic reactions, gastrointestinal intolerance, yeast infections, and *C. difficile* infection.⁴

Planktonic cultures of several different bacterial species have been mixed and inoculated into a glass tube containing a novel media formulation and a sterile polystyrene support for biofilm attachment and incubated aerobically at 37°C for 2 to 4 days (conditions mimicking the human body) in studies about biofilm formation.⁵ This model reliably supports the growth of polymicrobial biofilms, which accurately reflect the composition of human wound infections.^{6,7}

For this reason this study aims to find the incidence of ascending infection in open sterile surgical drains which are placed there after elective procedures; the study will only include patients who have had elective surgery at least 72 hours (3 days) ago to determine the utility and safety of these drains for long term use. The time criteria of 72 hours has been set to represent the average time taken by bacteria to form a biofilm within the human body; as stated above, based on a study by Dalton T et al.⁵

METHODS

This study was a cross sectional study conducted on 43 patients who underwent a surgery with a Class 1 (Clean) wound according to the CDC Classification. It was conducted from May through September 2018 at a Tertiary care hospital (JSS Hospital, Mysuru). It involved purposive sampling of drain tube tip samples from inside the surgical wound with strict aseptic precautions and routine culture and

sensitivity testing on the standard MacConkey and Blood Agars. A total of 43 cases were studied (n=43), in which a similar number of male and female patients were considered with no age consideration.

The study played no role in influencing the perioperative care of the patient and time of removal of the drain. The same was discussed and reviewed by the Institutional Ethics Committee and the study was granted approval and exempted from the requirement for ethical approval, since it did not influence patient care or disclose patient details throughout its course.

Inclusion criteria for the study included the following conditions-

- Any patient undergoing a clean surgery (with a CDC class 1 wound); in which the surgery itself could not be theoretically considered a source for inoculation of bacteria.

AND

- Drain tips maintained in situ for at least 72 hours; this time criteria was set to reflect the average time it takes for biofilms to form based on the studies mentioned above.⁵

Exclusion criteria included any of the following-

- Cases in which the surgical wound could be theoretically considered infected either before, during or after the surgery.
- Break in sterile techniques
- Clinical factors suggesting surgical site infection within 72 hours of the surgery
- Previously infected surgical site

STATISTICAL ANALYSIS-

The data thus collected was input onto Microsoft excel 10 and analysed using SPSS-22 version.

The data obtained was coded and entered into Microsoft excel worksheet and later imported and analysed using SPSS 22 version.

Descriptive statistics such as frequencies and percentages, mean and standard deviation were calculated. Cross tables were constructed, and inferential statistics Chi-square test and Fischer's Exact were applied and the association was tested. The statistical significance was evaluated at 5% level of significance ($p<0.05$).

RESULTS

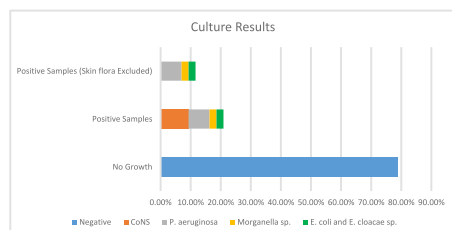
The data collected for all cases was reviewed, any routine culture and sensitivity coming back with bacterial growth was taken as positive

biofilm formation, and thus a positive indicator for future surgical site infection. For the same, initially 56 patients were considered out of which, 15 were excluded (n=43) based on exclusion criteria mentioned above.

Among the patients considered, 48.8% were female and 51.2% were male. In the samples sent from these patients, 79.1% reported no growth, whereas the remaining 18.9% reported a positive growth on culture. Most positive results came back as single organism growths, there was only one case that came back as multibacterial. Among the positive samples (20.9% of cases), it cumulatively included potential skin flora contaminants like Coagulase Negative Staphylococci (CoNS) (9.3%) and other non-floral bacteria (11.6%). The non-flora bacteria that grew from the culture samples sent were (Table 1)-

Table 1: Incidence of various non-floral bacteria among the sample size(n=43)

Bacteria	Positive samples
<i>Pseudomonas aeruginosa</i>	3(6.97%)
<i>Morganella</i> sp.	1(2.32%)
<i>Escherichia coli</i> and <i>Enterobacter cloacae</i> sp.	1(2.32%)



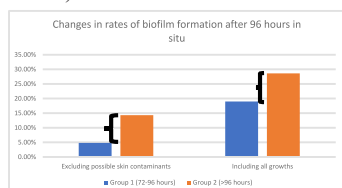
Graph 1: Results of drain tube tip culture.

If all skin contaminants are considered to be present because of incorrect drain handling during placement, while in situ or while removing the drain, then it may be considered that up to 88.4% of cases had no growth and thus no significant biofilm formation during their time in situ.

No patients among those included developed a surgical site infection or any other post-operative complication attributable to a surgical drain. The samples gathered were also stratified based on duration of placement within the patient into two groups i.e. patients with the drain in situ 72-96 hours (Group 1) and >96 hours (Group 2). Group 1 and Group 2 both had 21 patients each with 1 patient being classified as missed data and he/she was excluded from these calculations. If these samples are considered positive after exclusion of skin contaminants like CoNS, then Group 1 had 4.8% culture positive cases, whereas Group 2 had 19.0% culture positive samples. Even though this shows a nearly fourfold increase in biofilm formation when drains are left in situ >96 hours, there was no statistically significant association of culture positivity rate and time ($p=0.343$). The lack of statistical association is possibly due to the relatively small sample size of the study; nonetheless it still shows a clinically relevant increase in biofilm formation rates with the time that the drain is left in situ.

Since CoNS are commonly known pathogens implicated in a large number of surgical site infections, they may be considered as a potential positive result.^{8,9}

Hence, if all possible skin contaminants (i.e. CoNS) were to be considered as a positive result in the calculations, then Group 1 would contain 14.3% and Group 2 would contain 28.6% culture positive cases. This data shows a doubling of cases of drain biofilm formation, which may be clinically relevant but still did not gain a statistical significance ($p=0.453$).



Graph 2: Percentage of drains with a positive culture result (Group 1 v Group 2)

Thus, we can conclude that if a drain is left in situ for >96 hours the biofilm formation rate increases from a range of 4.8-14.3% to 19-

28.6%. No drain related complications (including Surgical Site Infection) were noted among the patients in this study.

DISCUSSION

The use of surgical drains in post-operative recovery has been hypothesised to be linked to surgical site infection due to ascending infection, but no clear correlation exists. There doesn't exist any consensus among literature stating surgical drains as an independent variable contributing to surgical site infection.^{10,11,12,13}

Hence, this study tries to establish the true extent of correlation, if any, by removing other confounding variables that may contribute to biofilm formation inside a drain; to an extent, and has only considered clean surgeries within its scope.

Results with similar trends were obtained in a study conducted on early removal of prophylactic intrabdominal drains after pancreatic head resection surgery by Dr. Manabu K et al. at Wakayama Medical University, Japan; which concluded that drain removal on postoperative day 4 was shown to be an independent factor in reducing the incidence of complications with pancreatic head resection, including intra-abdominal infections.¹⁴

Another randomised clinical trial by Dr K. C. Conlon et al. failed to show a reduction in the number of deaths or complications, including surgical site infection, with the addition of surgical intraperitoneal closed suction drainage after pancreatic resection surgery.¹⁵

Even though these studies are similar in their aim, the scope of these studies differs from ours as they have considered even Clean contaminated (CDC Class 2) wounds for their study and that may be a confounding variable in establishing post-op use of surgical drains as an independent variable in surgical site infection.

In another multicentre study published by Dr D. B. Herrick, the data suggest that patients with drains may be less likely to return to the operating room for surgical site infection.¹²

Despite the evidence of increasing trend of biofilm formation obtained from this study, a correlation between prolonged usage of surgical drains in the post-op period cannot be established due to the fact that statistical significance could not be obtained from the given data set. This is probably due a small sample size and hints towards a bigger study in the future with a larger sample and sample size, to effectively determine the true correlation of this increasing trend of infection.

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